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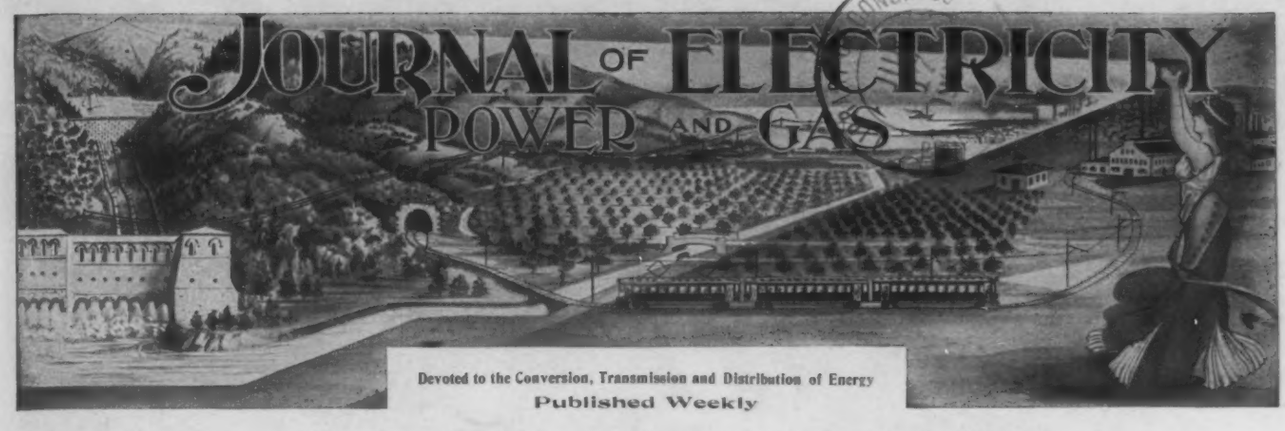
JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy
Published Weekly

BY THE TECHNICAL PUBLISHING COMPANY, 111 NEW MONTGOMERY STREET, SAN FRANCISCO, CAL.
Entered as second-class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the Act of Congress March 3, 1879.

VOL. XX. No. 24. SAN FRANCISCO, CAL., JUNE 13, 1908. Yearly subscription $2.50. Single copies 10 cents. Back numbers prior to current month 25 cents.

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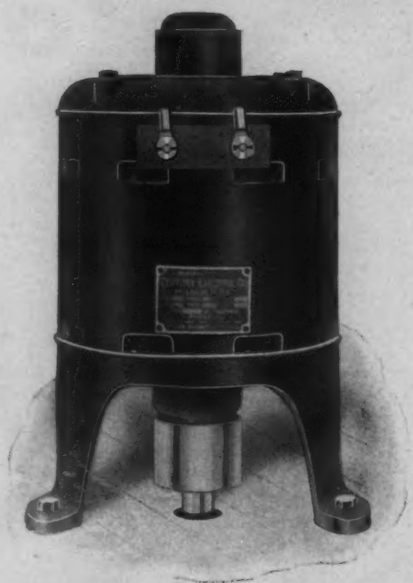

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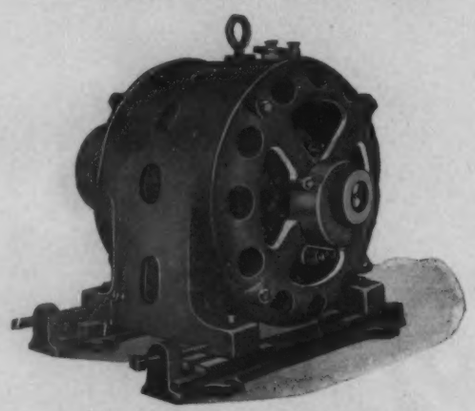

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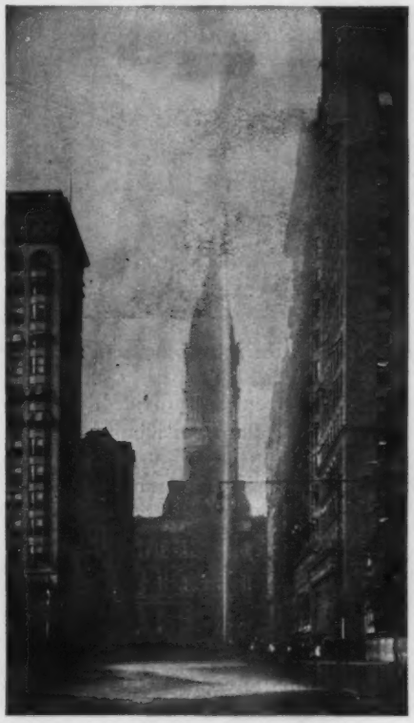
Devoted to the Conversion, Transmission and Distribution of Energy.

VOLUME XX. SAN FRANCISCO, CAL., JUNE 13, 1908 No. 24

INDEPENDENT HIGH PRESSURE FIRE SYSTEMS.*

In the United States, during the last fifteen years, high pressure fire lines have been a most important development. Among the earliest of these were the so-called "empty mains" leading from the rivers back into the business sections of Cleveland, Detroit, Milwaukee, and other lake cities. At Cleveland, for instance, some 16,500 feet of 6-inch, 8-inch and 10-inch cast iron pipe have been put down since early in 1891, affording additional protection partly in the business section and partly in the lumber district. When a large fire occurs in the protected area, the harbor fire boats, one of 7,000 and the other of 4,000 gallons capacity per minute, connect with these mains and effectively assist the city fire department. While kept full in summer, as these mains were not laid below frost line they are drained in winter; but the fire boats fill them quickly and provide a pressure of about 100 to 150 pounds at the hydrants in business streets well above the river. These mains at Cleveland have proven so effective that plans are now under consideration for large extensions, including perhaps an independent pumping station. At Detroit there are about 26,000 feet of 8-inch and 10-inch pipe, chiefly in separate 8-inch lines of various lengths, in business streets running back from the river, and served by fire boats. Two of these 8-inch lines are connected through 10-inch line laid in the business center. At Milwaukee, there are about 46,000 feet of similar 8-inch and 10-inch pipe in streets running back from the rivers and canals. At Buffalo, since the fall of 1897, about 8,800 feet of independent mains have been installed. The first of these mains were of steel, and the latter of cast iron, this change being necessary on account of the deterioration of the steel pipe. They are kept full in summer, and empty during extreme cold weather. One or two fire boats are used, as necessity requires, and at the farthest hydrant a pressure of 275 pounds has been obtained and maintained, and on one test the two boats gave a pressure of 350 pounds at a distance of 2,500 feet with one line from the hydrant. In practice, the pressure, of course, varies with the number of lines in use at a fire, and we understand that it rarely exceeds 200 pounds at the hydrant. One objection to these independent fire boat mains is that the fire boats may be prevented, by shipping, the blocking of slips by vessels, and in winter because of ice, from promptly reaching the bulkhead line for connection to mains. It is claimed that the fact that the pipes are empty in winter does not delay the supply, as the time occupied by fire boats in filling the mains about equals the time used by the fire company in proceeding from quarters and connecting hose to hydrant. On the other hand,



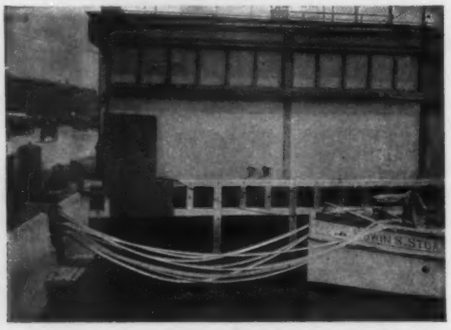
HIGH PRESSURE FIRE STREAM.

SIX HIGH PRESSURE STREAMS FROM ONE HYDRANT.

*Contributed by R. W. Martindale.

some engineers claim that these fire mains should be laid below frost line and kept full, always ready, and where practicable, connected up to sprinkler systems and to a standpipe in all large buildings, the high pressure to be turned in from street when necessary. These connections should prove a source of revenue, or at least cover their cost and maintenance. Probably the first complete system of independent fire mains is that at Providence, R. I., which was put down in 1897, and consists of some 29,400 feet of 12-inch, 16-inch and 24-inch cast iron pipe, supplied by gravity, which affords about 100 pounds pressure at the hydrants. The system is so designed, however, as to admit of adding pumps to bring the pressure up to about 150 pounds at the hydrant.

Later developments in the separate fire main systems are those at Philadelphia and Brooklyn, the latter as yet hardly complete. They are independent high pressure plants, ready for instant use. The mains laid below frost line are kept full under moderate pressure the year around, provision being made for circulation and draining, and they are connected with



FIRE BOAT CONNECTION.

independent stations in which are installed high pressure power pumps, which on signal bring the pressure almost immediately up to 200 pounds or more at the hydrant.

In Philadelphia the present system, which comprises some 34,000 feet of pipe, is an added protection to the congested area, which is about 6,500 feet long, running back from the Delaware River to Broad Street, by about 2,500 feet wide, between Walnut and Race Streets. The water supply is taken from the river. The pump house is on the water front, and is connected with numerous telephone stations throughout the district, and with the regular fire alarm system. There are also several fire boat connections for emergencies. The pump house contains seven units, with a combined capacity of about 10,400 gallons per minute. These are triplex, double-acting, geared plunger pumps, driven by gas engines. They supply a 20-inch discharge main, which, a short distance from the station, branches into 16-inch mains. There are three 12-inch mains and one 16-inch main leading from the river front to Broad Street, with cross connections of 8-inch mains at intervals of about every three blocks. These diameters are nominal, being reduced more or less by the thickness of metal in the pipe used. The mains, normally under about 75 pounds pressure, are kept filled through check valve connections with certain of the city water mains. In case of fire, within a minute the pressure at any hydrant may be brought up to 200 pounds or more if necessary. The pipe are all of cast iron, but in this Philadelphia system, flange pipe were used, and after completion, lead expansion joints were inserted to overcome the difficulty experienced with the flanged joints owing to expansion and contraction. For the earlier installations, including the fire line at Boston, the new systems at Brooklyn, and for the Manhattan district, New York, cast iron bell and spigot pipe were adopted. At Philadelphia, the hydrants are of the gate type, the pressure tending to force the valve off the seat, while those at Brooklyn are of the compression type, the tendency of the water pressure being to close the valve. While the New York and Brooklyn systems are naturally expected to be a marked improvement upon the earlier Philadelphia system, the latter has so far given excellent service, and in the congested section covered, the Board of Fire Underwriters have reduced the insurance rates 25 cents per $100, which represents a large annual saving in the cost of insurance in the protected district. In Brooklyn, it is estimated a similar reduction in the cost of insurance would result in a "saving of about $550,000 a year, which represents about 7.7 times the total estimated cost of maintenance and operation, plus interest and sinking fund charges for the high pressure fire system." The credit in Philadelphia, however, was in part due to the removal of a penalty for deficient water supply.

In the general scheme of the new installation of high pressure fire mains in New York, two independent pumping

SIX LINES FROM HIGH PRESSURE HYDRANT.

stations on the water front are provided, each having a present capacity of 15,000 gallons per minute, the pumps to be of the centrifugal type, multi-stage, direct connected to electric motors, which, in starting, will insure service at full pressure in about one minute. The pumps are designed to readily give 300 pounds pressure at the pump house, which, allowing for frictional loss in the mains, will give a pressure at the base of all hydrants of about 250 pounds per square inch. In each station the intake and discharge lines to the distribution mains will be duplicated, and at each station the pumping plant will be divided into so many units that it will be practically impossible for any station to completely break down or entirely cripple the high pressure system. The distribution mains will be of the cast iron bell and spigot type, having deep double lead grooves in both bell and spigot ends of the pipe. The special castings are of cast iron, with the exception of the larger tees and crosses, which, weakened by the area cut out for the branches, will be made of steel. The pipe will be of 1⅞-inch metal for 24-inch size, 1½-inch metal for 20-inch size, 1¼-inch metal for 16-inch size, 1-inch metal for 12-inch size, and ⅞-inch metal for 8-inch size (the latter for hydrant connections only), and tested at the foundry to a pressure of 650 pounds per square inch. These pipe are similar to those used in the Brooklyn system, in which 20-inch is now the largest diameter, and it will be noted that these cast iron pipe to work under 250 pounds pressure at the hydrant, are of the bell and spigot type, calked with lead in the ordinary way. Such joints have been tested to 750 pounds pressure, while 250 pounds is usually considered ample for these high pressure fire mains. The use of such mains is steadily finding favor, and must increase as their value and the lessened cost of insurance becomes apparent.

Probably the most notable and comprehensive system of fire protection is that contemplated by the city of San Francisco. After an exhaustive study of all the high pressure fire service systems in the United States and Canada installed, and proposed, embracing twenty-two cities, and the peculiar and interesting conditions in San Francisco, the plans were prepared and the system outlined fully in a printed report by Marsden Manson, C. E., City Engineer, also H. D. H. Cormick, Chief Assistant Engineer Board of Public Works, and T. W. Ransom, Consulting Mechanical Engineer, and under the direction of the Board of Public Works.

It is proposed to lay more than 91 miles of cast iron bell and spigot pipe with lead joints of sizes from 12 inch to 20 inch. All hydrant connections will be 8 inches. Cast iron has been adopted as the most serviceable metal, as at times the mains will be filled with salt water. It is a well known fact that cast iron deteriorates by corrosion more slowly than steel. Cast iron pipe, owing to its much lower tensile strength, must be made from 200 per cent to 300 per cent thicker than steel pipe to stand the pressures under which the system is to be operated. This greater volume of metal of itself insures a long life for the pipe.

The bell and spigot joint made with lead is flexible to a considerable degree, and will to a certain extent take care of vibrations due to earthquakes and strains on the pipe lines due to subsidence. In portions of the city which are over made or filled ground a special lead joint made by butting two spigot ends of pipe together in a long special cast iron sleeve, will be used, as it has been shown that the greatest damage to the present domestic supply system occurred in such sections. Valves will be so located that in case any part of the pipe system is broken, such sections can be cut out without impairing the efficiency of the rest of the system. The acreage covered by the proposed system will be about 5,300 or double the area burned over in the great conflagration of April, 1906, and greater by more than 300 per cent than is covered by the present system in New York City.

The amount of water to be supplied through the mains will be 35,000 gallons per minute, or about 16 per cent more than is contemplated by the systems of Chicago and New York.

The mains will be kept filled with fresh water by gravity from reservoirs filled by pumps, and pressures for fire purposes up to 327 pounds per square inch will be available.

Two storage reservoirs of 5,000,000 gallons capacity will be constructed on Twin Peaks at an elevation of 755 feet. A distributing reservoir of 500,000 gallons capacity will be located in the city overlooking a portion of the residential district at 495 feet elevation, and above the business district at an elevation of 329 feet will be constructed a low level distributing reservoir of 1,000,000 gallons capacity. The pumps supplying these reservoirs will have a capacity of 3,000,000 gallons daily. Two salt water emergency pumping stations will be located on the bay on opposite sides of the city with an ultimate capacity of 16,000 gallons per minute. Two fire boats are proposed, having a combined capacity of 8,000 gallons per minute, under 300 pounds pressure, and 4,000 gallons per minute under 150 pounds pressure.

A number of underground cisterns will be constructed in the streets. A telephone system for the exclusive use of the Fire Department is proposed.

The complete system is estimated to cost $5,200,000.

The situation of San Francisco is almost ideal for the installation of such a system of fire protection as outlined. The numerous hills of good elevation in and around the city provide locations for reservoirs, and insure by gravity all the pressure necessary to extinguish ordinary fires. In an emergency when great quantities of water are required, as in the case of a general conflagration, the salt water pumping stations will be brought into service as well as the fire boats on the bay.

A great system such as proposed is more necessary in San Francisco than in almost any other city in the country, owing to climatic and topographic conditions and the combustible nature of a large percentage of the buildings.

It is thought that the construction of the system as planned will be the means of a considerable reduction in insurance rates which are now unusually high.

Mention should be made that many of the smaller cities in the country are considering the installation of separate systems for fire protection. The city of Ocean Park, California, has on hand 4,400 feet of heavy cast iron bell and spigot pipe, which will shortly be laid between that city and Venice, to better protect them from fire. The city of Hanford has now under construction the second section of a separate system for fire protection, and here again cast iron bell and spigot pipe will be used of 6-inch and 8-inch size. The pressure here will be 140 pounds per square inch. When the first section was planned at Hanford sufficient consideration of the pipe to be used was not given, and cast iron pipe made in green sand of short lengths, and with rigid bolted joints were laid. The experience of Hanford and many other small cities goes to show the necessity at all times of securing the services of a competent engineer to lay out the work. The necessary expense for a good engineer and the best materials in so important an undertaking will be amply repaid by the added value of the system and the surety that it can be relied upon in an emergency. Then, too, a well laid out and constructed system is often the means of a substantial reduction in insurance rates, especially if it meet the requirements of the Board of Fire Underwriters. The city of Lodi recently voted bonds for the construction of a water works system of cast iron bell and spigot pipe, for fire protection and domestic supply. No expense will be spared to make the system effective. It was planned by an engineer of wide experience, along the lines of rules laid down by the Board of Fire Underwriters, and it is probable a reduction will be granted in fire insurance rates.

Chicago, Baltimore, Toronto and other cities have under consideration important independent fire main installations. Not only for large cities and towns are these mains practicable, but for important isolated manufacturing plants will they find favor. Many of the latter have their own electric power, which in case of fire could readily be diverted to electric motors direct connected to the centrifugal or other power pumps of an independent fire system, which in some instances can be combined with village or town protection. The effect on insurance rates will often justify the protected property owners in assuming alone the cost of installation and maintenance.

Hydraulic Power Mains.

For pressures up to 750 pounds, the smaller sizes of cast iron bell and spigot pipe may be used around manufacturing plants for underground mains, the form of socket being altered somewhat for pressures above 250 pounds. Such piping is made to order only. While hydraulic power is largely used by steel works and other manufacturing plants in this country, we have no installation for public supply corresponding to the well known plant of the London Hydraulic Power Company, which has now been in successful operation for more than twenty years, and supplies motive power from over 150 miles of mains, to which in 1905 were connected 5,597 machines. The power is available day and night the year around, operating direct-acting hydraulic lifts and motors, and is also used for injector fire hydrants, affording special fire protection, and for ejectors, the latter being extensively used for raising water. The first of these independent hydraulic power works was put down in 1877 at Hull. The plant in London was commenced seven years later, and such works have now been installed in Liverpool, Manchester, Glasgow and other cities in England, and at Melbourne and Sydney in Australia. In London, the company pumps its

water from the Thames, while in Manchester, for instance, the supply is taken from the city mains, which saves much in pumping. In London, the working pressure is 700 pounds, while in Manchester it is 1,120 pounds. All of the mains are of cast iron. Hydraulic power has uses and advantages which even electricity cannot supplant, and it would seem that in congested districts similar power plants could be worked to advantage and economy for office building elevators and lifts, and presses in warehouses, releasing valuable space now occupied by pumps and extra boilers, to say nothing of its use for numerous other power purposes.

In London, the average charge for hydraulic power is much the same as the average charge for electric energy within the same area, and as compared with electric lifts, the hydraulic elevator is certainly as good if not better, whether considered from the view point of safety, economy or convenience.

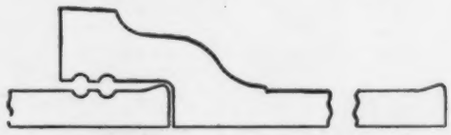
HANDLING PIPE WITH MOORE'S PATENT TRAVELER.

Sewers.

There is a notable and very marked increase in the use of cast iron pipe for sewers, not only for sewage force mains, but especially in locations liable to subsidence, such as in marshy ground, newly filled streets, or where the sub-soil conditions make desirable a more permanent construction than is secured by the ordinary brick sewer. Cast iron pipe are also used to advantage on hills, where the rush of water during storms is liable to wash out the ordinary brick or tile sewer which may have been disturbed by the action of frost. During the past year the leading cast iron pipe manufacturers have furnished for sewers, several lines of 30-inch to 60-inch cast iron pipe, and their increasing use for sewers has become an important factor. Except for force mains, usually standard pipe of dimensions and weights suitable for pressures due to not over 100 feet head are specified, but there are often locations which necessitate the use of heavier pipe. The thickness of pipe to be used is a question for the engineer, and while the use of cast iron pipe naturally involves a larger initial cost than for other culvert materials, this difference is inconsiderable when compared with advantages secured through the more substantial and lasting construction.

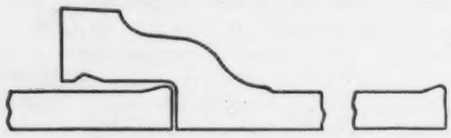
Culverts and Drains.

The very extensive use nowadays of cast iron pipe for railroad culverts and drains is well understood, as is also their adoption by township commissioners for drains under country roads. They are indeed an important factor in "good roads" development. The largely increased demand is the natural result which has followed the appreciation of the many advantages derived from the use of cast iron pipe for culverts. One length of cast iron pipe will lay 12 feet, and may be used instead of six 2-foot lengths of vitrified pipe, thus minimizing the risk of washout by markedly reducing the number of joints. As compared with a brick or stone culvert, the cast iron pipe culvert is less liable to be affected by the action of frost, while the smooth interior of the pipe is not easily obstructed and may readily be cleaned. Aside from this, cast iron pipe culverts are of relatively great strength and easily and cheaply put down, it being simply necessary to see that the pipe have an even bearing, that the joints are supported, and that the material about the pipe is carefully tamped under and around them, at least up to their center line. They are often laid even without the setting in masonry of the upstream end. A brick or masonry facing, however, is desirable for permanent culverts, as tending to prevent undermining the pipe. Where roads cross streams which in times of freshet may be greatly enlarged, it is not unusual to provide several parallel lines of pipe to take care of the increased flow. Cast iron pipe is now made up to 84 inches inside diameter. Where there is not space for the larger diameters, two or more parallel lines of smaller pipe may often be used to advantage. The following table shows the weight per cubic foot of embankment material. To determine the pressure per square foot of embankment upon the horizontal surface of pipe, multiply the weight per cubic foot by the height of the fill above the pipe. Thus, it will be seen, for high embankments only heavy pipe should be used, and great care taken to so lay the pipe that they will not be subject to undue subsidence:



DOUBLE GROOVE BELL AND SPIGOT HIGH PRESSURE PIPE.

DOUBLE GROOVE BELL AND REGULAR SPIGOT HIGH PRESSURE PIPE.



STANDARD HIGH PRESSURE BELL AND SPIGOT.

Embankment Materials—Weights per Cubic Foot.

Material	Average Weight	Specific Gravity	Average Voids
Granite	166 pounds	2.666	.....
Coarse Gravel	120 pounds	1.925	.28%
Gravel	116 pounds	1.861	.30%
Sharp Sand	110 pounds	1.765	.33%
Clay	125 pounds	1.440	.12%
Water	62.5 pounds	1.000	.....

DIRECT AIR PRESSURE PUMPING.

As a preliminary to the description of the oil engine plant just installed in the pumping station at Cypress Lawn Cemetery, near San Francisco, the following details of a similar system will prove of interest. At Cypress Lawn the engine drives an air compressor, furnishing air for pumping, and also drives a triplex pump, forcing water from the reservoir through the mains:

During several months of the year 1907, an extended series of tests was made on a driven well, near the plant of the Westinghouse Air Brake Company, at Wilmerding, Pa., to determine the amount of water raised, air required, and other necessary data relative to pumping by direct air pressure. As wide a range of conditions as possible was covered in regard to different sizes of pipe and different combinations of "lift" and "submergence," obtaining for each condition the most suitable and economical arrangement. The "lift" is the vertical distance from the water level in the well to the point at which the water is discharged. The "submergence" is the distance from the water level down to the point in the well where air is admitted to the discharge pipe.

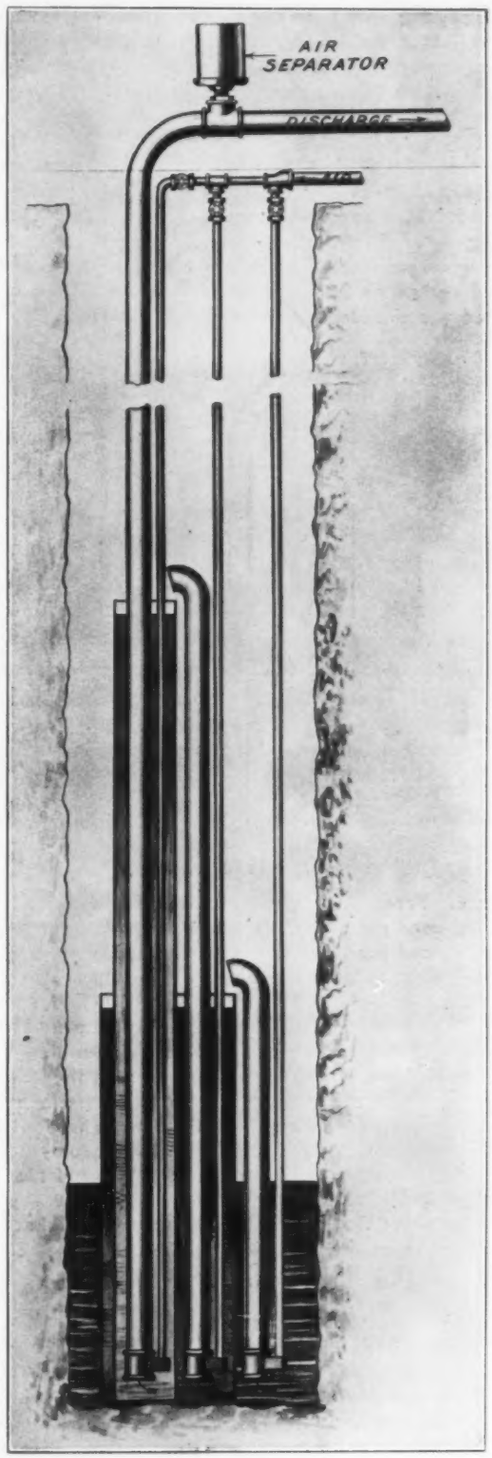
Since the variety of combinations of these distances and sizes is infinite, a limited number of each were determined upon, which would give enough points on a curve to cover practically the entire range for each size of pipe.

Arrangement of Apparatus.

The well used is 174 feet deep from the surface of the ground, has 6-inch casing, and the water level is ordinarily from 16 feet to 20 feet below the surface. An oil well derrick was constructed over the well, with platforms at various heights to provide means for altering the lift. The space inside the derrick, below the first platform, was housed in to protect those making the tests, and provide suitable space for the tanks, measuring apparatus, etc., required. Each length of pipe was measured and marked as it was placed in the discharge pipe, so that an accurate knowledge of the distance to the air inlet and to point of discharge was always at hand. To measure the distance from the ground to the water level, a float was used, consisting of a tin tube about ½ inch in diameter and 4½ feet long, hermetically sealed, weighted at the bottom, so as to float vertically, and pointed at both ends to assist in its introduction into, or removal from the casing. A stout "Silver Lake" cord was fastened to a ring in the upper end, and brass markers were attached to this cord every four feet, each marker stamped with the distance from the water level point on the float.

The air supply was obtained from a one-inch connection to the air system of the Westinghouse air brake shops. The arrangement of piping, reservoirs, etc., is shown diagrammatically in Fig. 1. Two air storage reservoirs, 30½x84 inches, received air from the supply through a three-way cock, so that only one tank could be charged at one time. At the other end of these tanks, connection was made through a similar three-way cock to the line to the well. In this line was placed a 14x33-inch reservoir, a globe valve and a cutout cock. The shop air system averages from 140 to 160 pounds pressure, to which the storage tanks were charged. Tank No. 2 was used for measuring the air in the tests, and Tank No. 1 for starting the pumping operation. The volumes of these tanks and their piping was obtained by water measurements. A special test gauge was attached to tank No. 2. The globe valve in the well line was used to regulate the pressure in the latter. Such pressure was always much less than the storage pressure, and had to be held constant. The cutout cock was used for cutting off all supply to the well. The small reservoir simply increased the volume of the well line to make it easier to hold its pressure constant.

The special fitting used for admitting air into the discharge pipe is also shown in Fig. 1; it consisted of a pipe sleeve enlarged on one side, the upper surface of the enlarged part being drilled and tapped for three air pipes and 1¼-inch gauge pipe. With the large discharge pipes, there was not room enough inside the casing to get a large air supply pipe, so that two or three smaller sizes were substituted. By this arrangement, also, the effect of changing the sizes of air



COMPOUND ARRANGEMENT OF DIRECT AIR PRESSURE PUMPS, FOR SHALLOW WELLS.

supply pipes was easily obtained, since any one of these pipes could be closed at the top by suitable cutout cocks. The gauge pipe was connected with a test gauge to show the pressure of the air entering the well. The water is always blown

out of this pipe when starting the pumping operation. Another test gauge was placed in the air line to the well, so that pressures at top and bottom of air inlet pipe were noted.

The discharge pipe passed up through the roof of the cabin to the point of discharge, at this point the air and water lifted passed into an air separator, shown in Fig. 2. The air passing upward to the atmosphere, and the water falling by gravity into one of the two weighing tanks. Just under the roof of the cabin was a large three-way cock, by means of which the water was directed into either one of the tanks and weighed by means of the platform scales upon which they rested.

The Tests.

Nearly eighteen hundred tests were made, covering from 350 to 400 different combinations of discharge pipe lift and submergence. From the figures obtained in these tests, curves were plotted, showing the variation of cubic feet of air used per gallon of water raised, and the gallons of water delivered per minute, for the different ratios of lift to submergence. From these curves, it was found that the cubic feet of air used per gallon of water raised, and the gallons of water delivered per minute, are practically the same for each ratio of lift to submergence for any submergence of a given size of discharge pipe. For example, a lift of 10 feet and a submergence of 20 feet will take the same amount of air per gallon, or lift the same number of gallons per minute, as a lift of 100 feet and a submergence of 200 feet, the size of discharge pipe being the same. In both these cases the ratio is identical, while the submergence in the latter is ten times as great as that in the former. Consequently, it is only necessary to consider the **ratio** of lift to submergence and the size of discharge pipe.

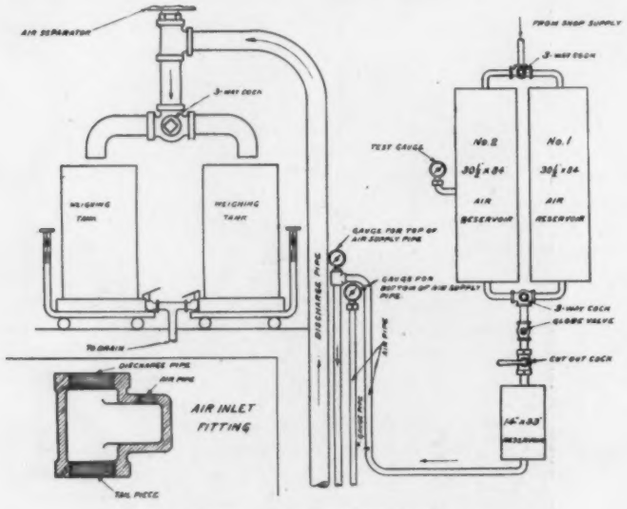


FIG. 1. PIPING DIAGRAM.

It was also found that, for a given size of discharge pipe, the gallons of water raised per minute decrease as the ratio of lift to submergence increases. Also, the cubic feet of free air per gallon of water raised increase as the ratio increases for a given size of discharge pipe, and for a given ratio, it decreases as the size of discharge pipe increases.

Air Pressure.

As regards the air pressure required, it was found that the smallest pressure possible that would give a continuous flow from the well, was the proper pressure to use. It was found that, if the air pressure was choked down slightly below this point, the water would come out intermittently in spurts, and the air required per gallon was slightly less than with the continuous flow, but the water delivered was considerably less. On the other hand, if the air pressure was gradually increased above that just required to give a steady flow, the quantity of water delivered would increase somewhat, but the air per gallon increases in a greater proportion, and, as the air pressure is further increased, the gain in the quantity of water delivered grows less until, at a certain point, it stops, and from then on the water delivered **decreases** in amount.

It is very easy to regulate the air supply by the sound of the discharge. The point at which the flow becomes steady is quickly recognized.

Selection of Proper Ratios.

From the results obtained, it would appear that for a given lift, the further down in the well the submergence is made, the more economical the result would be. This is true so far as the well is concerned, but it must be considered that the greater the depth of the air inlet, the greater the air pressure must be, and, consequently, the more horsepower must be employed to compress the air. The quantity of air required to operate the well decreases as the depth is greater, while the horsepower required to compress a cubic foot of air increases with the depth. A curve representing the horsepower per gallon of water raised for varying depths and constant lift, will at first decrease as the depth increases, until it reaches a minimum point, after which it increases. This point represents the most economical ratio for the given lift. To learn where this point would be, some tables and curves were made, which gave the horsepower per gallon of water raised for the different lifts and different sizes of pipe, with various ratios of lift and submergence, from which it appears that the most economical ratios for a given discharge pipe decrease as the lift increases, and for a given lift they increase as the discharge pipe increases.

Concerning the use of a "tail" piece in the discharge pipe below the air inlet, it was found that this piece is essential when starting the pumping operation, as it tends to prevent the air from backing down into the well and rising in the casing, outside of the discharge pipe.

The fitting used for entering the air into the discharge pipe was particularly well adapted to the purpose, because it offered no impediment to the free passage of the water. The results obtained indicate beyond doubt that anything in the shape of a jet or pipe, introduced into the discharge pipe, not only has no value in assisting the pumping operation but is actually detrimental, by forming an obstacle to the free passage of water. The enlarged sleeve not only offers little resistance to the water, but makes it possible to install the air pipe very close to the discharge pipe.

Size of Air Pipe.

The size of air pipe depends upon the quantity of air required, its pressure and velocity, the latter depends upon the difference in pressure between the top and bottom of the air supply pipe, or, in other words, how many pounds pressure one is willing to sacrifice to force the air through the pipe.

Taking the results of the tests, and assuming that the drop in pressure is proportional to the length of the air supply pipe, it was found that, for one pound drop per hundred feet, the velocity is about 27 ft. per second; for 2 pounds drop 42 ft. per second, and for 3 pounds drop 53 ft. per second. Economical operation is, of course, more easily maintained by having the drop in air pressure as small as possible.

Perhaps it would be well to give here a brief description of the manner in which the operation occurs inside the well. As the compressed air enters the discharge pipe at a pressure only slightly above the hydrostatic head, the column of water above is forced upward. Air continues to enter, filling up the space left by the rising body of water until the top of the water column reaches the discharge opening. The moment that a portion of the rising water is discharged, the weight of the column is thereby reduced, and the air beneath it will correspondingly expand, thus reducing the pressure on the water in the discharge pipe below the air inlet. The weight of the water in the well, outside of the discharge pipe, then forces the water upward into the pipe, stopping the inflow of air. The pressure in the air supply pipe is quickly re-instated by its connection with the supply, so that it again forces an entrance into the discharge pipe. This is repeated until the

whole discharge pipe, above the air inlet, is filled with alternate bodies of air and water, the combined weight of which is enough less than the water in the well to keep up a constant flow of water into the discharge pipe. As each body of air rises, the total weight above it grows less, so that it continues to expand until, when it reaches the discharge, it issues at atmospheric pressure. In this way a continuous flow from

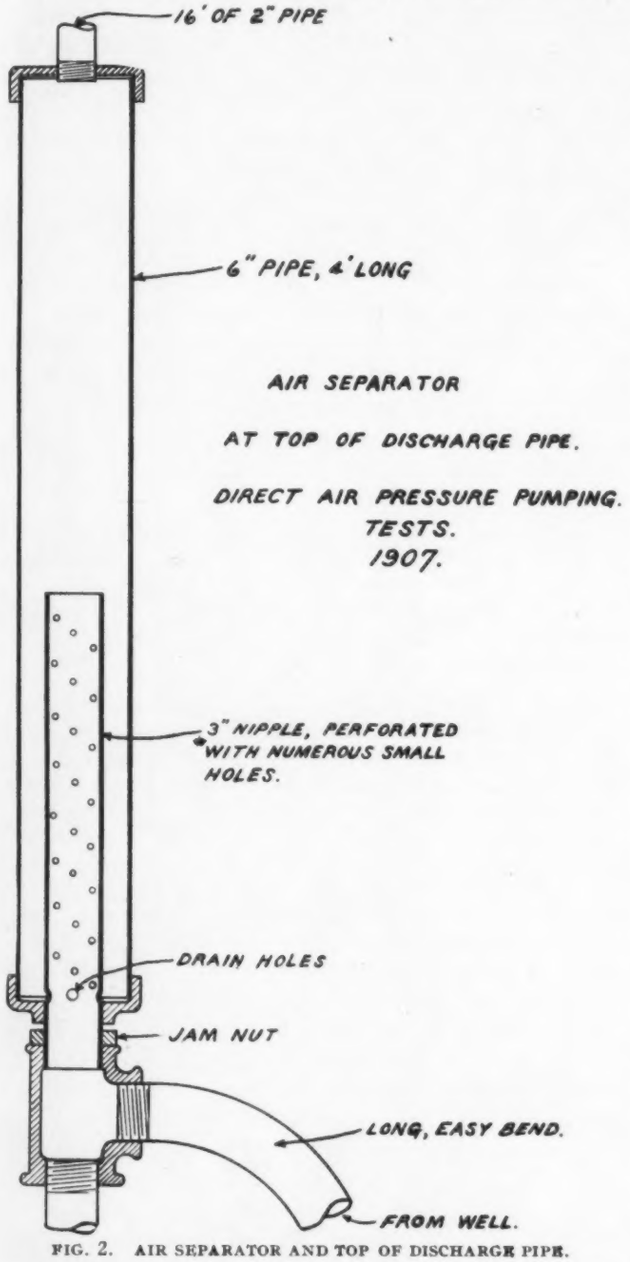


FIG. 2. AIR SEPARATOR AND TOP OF DISCHARGE PIPE.

the well is maintained as long as a sufficient quantity of air is supplied, and the capacity of the well is not overtaxed.

In this connection, it may be interesting to note that a model was made not long ago, of a deep well, having casing and discharge pipe in glass, for exhibition purposes. The above description of operation, deduced from the action of the test well, was entirely confirmed by the operation of this glass model, and, in addition, the cause of some of the losses encountered was learned.

The principal loss appears to be due to a slip back of a portion of each layer of water to the next succeeding layer, caused by the friction of the sides of the discharge pipe. Each change in diameter of the pipe, such as coupling or joints, materially increases this slip. Also, any obstruction or sudden bend adds to this loss.

The bodies of air are not clear, but are filled with bubbles and foam, caused by the presence of the water slipping back, but the bodies of water are clear and distinct.

In starting the well operation, it is necessary to admit air slowly into the well. The valve should only be opened a small amount, allowing the air to flow slowly, and gradually build up to the pressure required. After opening the valve, the pumping will not commence immediately, but several seconds, perhaps even a minute, will elapse before the water discharges, then it comes with a great rush. After this first rush of water there comes a lull for a few seconds, and then the pumping operation begins more uniformly. By opening the valve only a small amount, the air supplied will be a little less than required, and cause an intermittent flow from the well. The valve can then be opened gradually until the flow becomes continuous, which is the proper position in which to leave it.

OIL FUEL FOR SHIPS.

Consul John L. Griffiths makes the following report from Liverpool on the extending utilization of petroleum for ship propulsion:

The use of oil as fuel has engaged the attention of the British Admiralty for some time, and it has recently been decided to establish oil storage tanks in various parts of the United Kingdom to insure convenient sources of supply. Birkenhead, directly opposite Liverpool, has been selected as one of the supply centers. The experiments conducted by the Admiralty during the past twelve years were not at first satisfactory, and two adverse reports were made prior to 1902. Since then the tests have been of such a character as to reverse the original judgment of the Admiralty, and it may now be said that the importance of oil fuel is recognized by that body, and that its use will be extended in the future as rapidly as possible.

It is claimed that through the use of oil the number of men now required to do the stoking and trimming would be reduced by two-thirds, as the moving and stoking of the oil is automatically accomplished by steam pumps and pipes, instead of by stokers and trimmers as in the case of coal. While it is difficult with coal fires at full speed to maintain sufficient steam, it has been demonstrated that with oil fuel this difficulty would be overcome, and that when the speed is reduced the boilers are under such perfect control that the safety valves do not lift.

The oil, it is suggested, could be stored in the double bottom, now taken up by water ballast. In the case of the navy, one of the great advantages claimed for oil is the absence of a great volume of black smoke when vessels are proceeding at great speed and which serves to give information to the enemy. The evaporative value of oil is much greater than that of coal so that while forty-five cubic feet of bunker space is required for a ton of coal, only thirty-eight cubic feet is needed for a ton of oil. It will readily be seen how significant this difference would be to the great ocean-going steamers and how much space now set apart in them for the storage of coal would be released for cargo purposes and the accommodation of passengers.

The British navy has in service oil-using torpedo boats with a capacity of thirty-four knots. One of the drawbacks at the present time to the extensive use of oil fuel at sea is the high cost and the difficulty in many instances of securing it. The cost of oil in Great Britain has no doubt seriously interfered with its adoption for steamships and for a variety of industrial purposes. With a reduction in price the field for its employment would be greatly enlarged. The advantages of oil fuel briefly summarized are economy of space, absence of soot and cinders, elimination of the loss of time consumed in burning down and cleaning fires when coal is used, the ease with which oil can be bunkered, and the quickness with which a full head of steam can be generated.

THE JOURNAL OF ELECTRICITY POWER AND GAS

Published Weekly by

THE TECHNICAL PUBLISHING COMPANY

111 New Montgomery St., San Francisco, California

E. B. STRONG, President

E. M. SCRIBNER, Vice-Pres. and Gen'l Manager.

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Yearly subscription, $2.50. Single copies, 10 cts. Back numbers prior to the current month, 25 cts. Canadian subscription 3.50.$ Foreign subscription, $4.00.

Subscriptions cannot commence with back numbers.

Manuscripts submitted must be accompanied by postage to insure return.

Address all communications and make all remittances payable to The Technical Publishing Company

Entered as second-class matter at the San Francisco Post Office as "The Electrical Journal," July 1895.

Entry changed to "The Journal of Electricity," September, 1895.

Entry changed to "The Journal of Electricity, Power and Gas," August 15, 1899.

Entry changed May 1, 1906, to "The Journal of Electricity, Power and Gas," Weekly.

VOL. XX JUNE 13, 1908 No. 24

EDITORIAL.

E. M. SCRIBNER.

As shown in the heading above, our readers will note that Mr. E. M. Scribner, for some years past connected with the Western Electric Company, has severed his connection with them, and become associated with the Technical Publishing Company, as vice-president and general manager. Mr. Scribner entered the organizaton of the Western Electric Co. in 1889, remaining in charge of their Supply Sales Department, at New York and Chicago, until 1896, in which year he acquired an interest in the Bryant Electric Co., of Bridgeport, Conn., and for six years devoted his time to their sales work. He then again took up his work with the Western Electric Company, in full charge of their general supply sales department, with headquarters at Chicago. In 1905 he located on the Pacific Coast, at San Francisco, in charge of their Pacific Coast interests, occupying at the same time the position of president and director of their several subsidiary companies. These services have eminently fitted him to carry on the work of the "Journal of Electricity, Power and Gas," to which he is a notable accession of strength. Thorough knowledge of the electrical business, and a wide acquaintance with electrical men throughout the country, give him an unusual command of the situation. A genial personality has won him many friends among former competitors, whose interests he will now seek to promote. His entrance to the field of journalism will but serve to more closely cement these friendly ties, and as an active representative he cannot fail to open up to Eastern manufacturers the electric potentialities of the West.

ELECTRICAL CONTRACTING TROUBLES.

Because of his intimate knowledge of his peculiar troubles, every man is likely to imagine that his own business is a little harder than his neighbors, and often the greater his difficulties the more suggestions he receives for their betterment. Therefore, while we feel justified in commenting upon the conditions existing in the business of electrical contracting, it should be kept in mind that such gratuitous advice is worth just what it costs.

In electrical contracting, as well as in many other lines of trade, exist the anomalous conditions of a high wage scale and many unemployed workers. But such artificial evasions of the universal law of supply and demand cannot last long. Wages must be reduced unless more work is provided. Journeymen are contracting at half rates to the detriment not only of legitimate contractors, but also of their fellow workers. Recognizing this fact, the union proposes to deny cards to members who engage in such practices. This expedient is temporary at best, for mere membership in an electrical workers' union is small solace to a man looking for a job. In San Francisco, for instance, there are something like three hundred journeyman electricians out of work. Every builder is besieged with proffers for cheap electric wiring, and in the case of many small jobs these grip-sack artists often land the contract.

Further business demoralization is caused by the plumbers' helpers and hardware salesmen, who consider themselves capable of installing electric systems. They are often little better equipped for such work than is a blacksmith as a prescription clerk. Their work is usually done in older buildings, which are not inspected and whose owners do not know of the municipal certificate requirement. To such carelessness is due much of the so-called fire hazard of electricity. Such reckless and shiftless work by "fake" wiremen is a danger that few realize.

They do not recognize the great strides recently made in electrical construction, and the elimination of the old idea that the mere ability to string a few electric-bell wires is the only requisite. Today electrical construction involves complicated problems and requires technical knowledge and skill that can only be acquired by experience. Furthermore, it is a business that properly involves large sums of money and a sufficient ability to get and to give credit. In an advisory capacity also, the contractor is familiar with the principles of illuminating engineering, and on his judgment depends the safeguarding of our eyesight. Such a high standard cannot be furnished by the helper and the "farmer," whose chief qualifications consist in their

cheapness. This short-sighted policy is, however, likely to prove the more costly in the end, and on its elimination depends satisfaction.

To remedy these evils there seems to be no more feasible plan than that of requiring a license as a guarantee of efficiency. Such a license should be granted only to those who may qualify by a written and oral examination to the requirements of a commission of competent electricians. As a further tender of good faith and responsibility, we would suggest a nominal charge or fee, to be collected from all contractors, and also that they be required to employ only licensed electricians.

PERSONAL.

C. W. Koiner is now general manager and engineer of the Pasadena, Cal., municipal lighting plant.

G. A. Wilbur, electrical manufacturers' agent, has moved to 564 Howard Street, San Francisco.

E. C. Bradley, vice-president and general manager of the Pacific Telephone Company, is making a business trip East.

Walter H. Inbusch, of the Pacific Telephone and Telegraph Company, has been transferred from Los Angeles to San Francisco, California.

Clem A. Copeland, electrical and mechanical engineer, of Los Angeles, has removed his office from the Citizens' National Bank Building to Suite 1400 Union Trust Building.

TRADE CATALOGUES.

Catalogue No. 22, from the Chicago Fuse Wire & Manufacturing Company, 170 South Clinton Street, Chicago, Ill., illustrates and describes "Union" switch boxes, outlet boxes and covers.

The Cutler-Hammer Manufacturing Company, of Milwaukee, has issued a 16-page pamphlet descriptive of their "Wirt Type" dynamo brush, designed for use with low-tension, direct-current motors and generators, alternating current generators, plating dynamos, exciters, etc. In addition to the descriptive matter and price list, the pamphlet contains useful information on the care of commutators and brushes.

CIVIL SERVICE EXAMINATION.

The United States Civil Service Commission announces an examination on July 8-9, 1908, to secure eligibles from which to make certification to fill a vacancy in the position of forti fication draftsman, Engineer Department-at-Large, San Francisco, Cal., at an entrance salary of $1,500 per annum, and vacancies requiring similar qualifications as they may occur. The examination will consist of engineering (including building materials and construction, elements of design in steel and reinforced concrete), topographic drawing, lettering and preparation of detailed drawings from sketches or descriptions, training and experience.

The United States Civil Service Commission announces an examination on July 1-2, 1908, to secure eligibles from which to make certification to fill a vacancy in the position of hydrographic draftsman, $900 per annum, in the Coast and Geodetic Survey, and vacancies requiring similar qualifications as they may occur in any branch of the service. The examination will consist of projections, mathematics, hydrographic surveying, etc., drawing and lettering, training and experience (rated on application).

TIMBER IDENTIFICATION.

It is doubtful if any of the laboratories maintained by the government for scientific research are more unique in character, and yet bear promise of more important results, than one which has just been established in Washington by the United States Forest Service for investigating the structure of commercially important woods. Laymen will not understand the significance of the proposed investigations carried on in this laboratory so quickly as architects, builders and other wood users, who, in these days of growing scarcity of the more valuable woods, are seriously perplexed in identifying substitutes. Mistakes of this kind in identification have, in the last few years, in several instances, meant the loss of thousands of dollars, and many embarrassing law suits.

Nearly any user of lumber can recognize, and name offhand, all the usual trees of the forest when he sees them growing, and not much difficulty is encountered in identifying the common kind of lumber in a mill yard, because he knows the few trees from which the yard lumber comes. But common kinds are growing scarce, and woods not often cut heretofore, are appearing in the markets. The most experienced men are sometimes puzzled when they try to identify them, and persons with less experience have still more trouble. Is a certain wood gum or elm? Is another cucumber, linn, or poplar? Is a stick sugar maple or red maple? Doubts may arise whether a piece is hemlock or spruce, or whether it is lodgepole pine or fir, or whether a shingle is cypress or cedar. A dealer may buy red oak and suspect that he is getting something else. There are thirty or more important species of oak. The best lumber dealer might not know which is which in the lumber pile, or if he knows, he might not know how to prove it.

Many of these woods look alike, even to the trained eye of the millman or the builder, and yet they are widely different in value for certain purposes, and it is of the greatest importance to be able to distinguish them quickly and certainly. Again, a new wood may come to a man's notice for the first time, and it may be necessary for him to decide what it is and what it is worth.

The government has been helping individual lumber users for some time, but the facilities have not been near so complete as they are now. It is to meet such needs and answer such questions, that the Forest Service has established the laboratory, and placed it in charge of a trained dendrologist. Architects, lumbermen, manufacturers and makers of woodware are already sending in samples of wood for identification, and asking if there are not some structural characters by means of which such woods may be conveniently separated for relative species having greater or less value for some specific purpose.

The laboratory will investigate in a practical way. The structure of the woods, sections lengthwise and crosswise, will be studied so as to separate by structure alone the various species of a genus. Analytical keys to the trees of each group will be worked out. These will be based on the arrangement and character of the pores discernible to the naked eye, or by a hand lens.

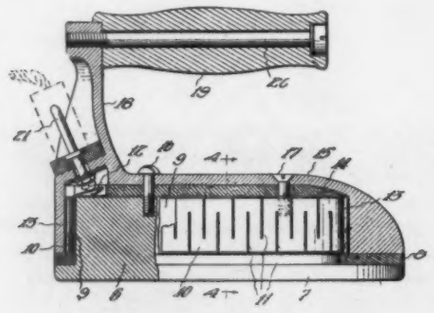
The results will be published from time to time with good illustrations and placed at the disposal of lumber users. After all the important groups of wood, such as oaks, pines and firs, have been studied and the results published separately, the several monographs will be collected and published in one volume.

A work of this character has long been in demand by architects, builders and other users of lumber. It will, in most cases, enable even a non-technically trained man to determine quite readily the wood he deals with by means of an ordinary hand lens, and by comparing the wood in question with the photographs of cross and long sections given in these monographs.

PATENTS

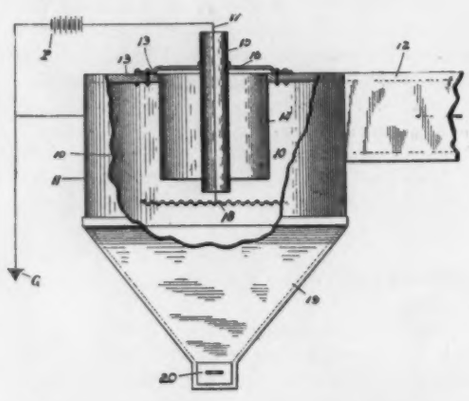
ELECTRIC FLAT-IRON AND CONDUCTOR. 888,843. Paul E. Oswald, Los Angeles, Cal.

An electric flat-iron comprising a body having a ledge at the bottom thereof, a heat and electric insulating washer on said ledge, a sheet of insulating material above washer and around body, a compressed graphite ribbon having staggered slits in its opposite sides exterior insulating material, con-



tacts secured to the ends of ribbon, heat and electric insulating material exterior ribbon, and within slits, heat and electric insulating material upon body and conductor, a cover for body and conductor having a handle secured thereto and contact posts secured to and insulated from the cover and engaging the contacts secured to the conductor.

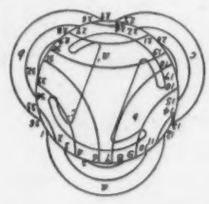
APPARATUS FOR ELECTRICAL SEPARATION OF PARTICLES FROM A FLUID STREAM. 888,638. Lawrence N. Morscher, Enterprise, Kas., assignor to William J. Ehrsam and Lawrence N. Morscher, co-trustees, Enterprise, Kans.



An apparatus for separating particles from a fluid stream comprising, a pair of electrodes to be electrically charged at different potentials and arranged one within the other with an annular separating chamber in the field of electrodes having an induction passage leading thereinto, chamber also having a fluid-eduction passage leading therefrom, and a non-charged member arranged to receive the precipitated particles.

ARMATURE-WINDING FOR ELECTRICAL MACHINES. 888,514. Benjamin G. Lamme, Pittsburg, Pa., assignor to Westinghouse Electric & Manufacturing Company.

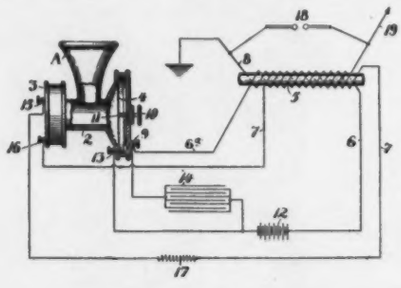
A winding for polyphase electrical machines comprising a plurality of groups of coils for each phase of current that



induce corresponding opposite magnetic poles approximately 180 electrical degrees apart, the sides of the coils of each group alternating in position with the sides of those of other groups that correspond to the other phase or phases of current.

WIRELESS TELEPHONE. 889,031. Francis J. McCarty, assignor to McCarty Wireless Telephone Co., San Francisco, Cal.

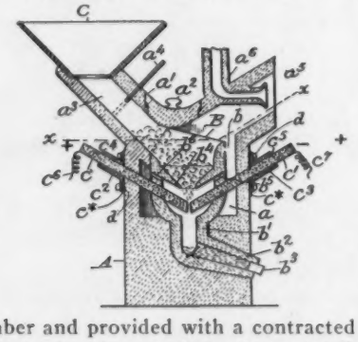
In a wireless telephone, means for intensifying the vibrations from a transmitting device, means consisting of a transmitting diaphragm with metallic contact points, an opposed



microphone transmitter, an induction coil including two primary, and a secondary winding, one of primary windings being connected with the diaphragm, and the other with the microphone, a local battery, connections there-through with the coil, a spark-gap interposed in the secondary circuit, and aerial and ground wires connected with secondary wire.

ELECTRIC FURNACE. 888,877. Leon Dion, Wilkes-Barre, Pa., assignor to The Americus Electro-Hermetic Company, Wilkes-Barre, Pa.

The combination in an electric furnace, with an inclosing structure provided in its interior with a chamber, of a bowl or crucible for receiving the material to be treated, arranged



in such chamber and provided with a contracted lower chamber portion to receive the metal or other material when fused, and electrodes, adapted to be connected with a source of electric supply, arranged to project into the bowl or crucible and across the path of travel of the material being treated as such material passes downward through the bowl or crucible.

INDUSTRIAL

COMPOUND ENGINE GENERATING SETS.

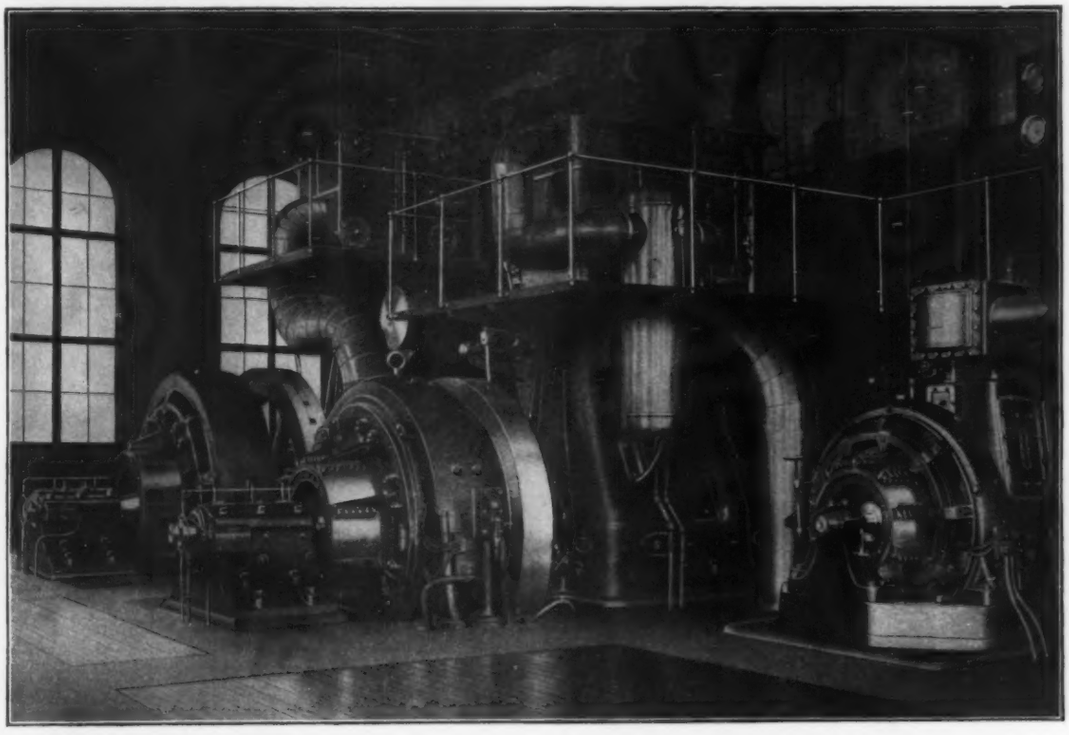
The most important consideration in the design of the power plant is the type and size of the main engine or generating set. Even though the apparatus for the generation of steam is economical, the total amount of steam used by the engine is the real factor that determines the size of all the apparatus as well as the amount of fuel burnt in a given time. In some sections of the country the price of fuel is so great that owners of manufacturing plants endeavor to get their power and light at the least possible cost, and most manufacturers realize that it is better to increase the first cost in order that a continual saving may be effected as long as the apparatus is in use. For this reason it is usual to purchase a compound engine if the plant is of any considerable size.

For many years the B. F. Sturtevant Company has been supplying generating sets in small sizes, apparatus which has proven of great success. This is shown by the fact that the Sturtevant generating sets of 50 to 100 kilowatt capacity are frequently installed in the vessels of the United States Navy, the rigid specifications, as drawn up by the government, making it difficult for any but high-grade sets to receive consideration.

The B. F. Sturtevant Company has added to its line of generating sets by increasing both the number and the capacity. Sturtevant generating sets from 150 to 500 kilowatts with compound engines of the four-valve type show remarkable economy. This is made possible by reducing the clearances and using gridiron valves with an auxiliary or cut-off gridiron valve on each steam valve. These sets made up of compound engines and Sturtevant direct-connected ten-pole generators are especially adapted to small electric-lighting plants and industrial establishments. They are of medium speeds, and being vertical require but little floor space, thus permitting the power house to be erected at minimum cost. They were originally designed as condensing engines, but can, of course, be run non-condensing.

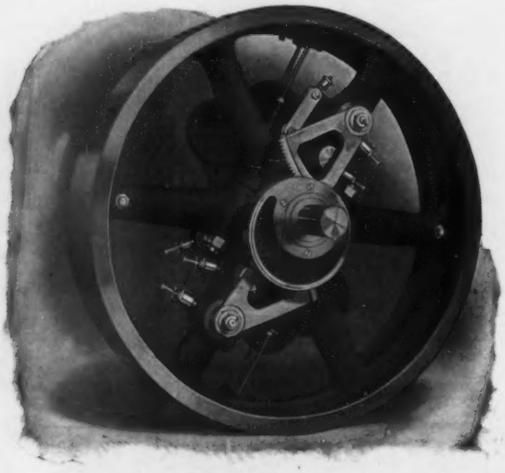
In addition to the advantages as regards economy, the Sturtevant generating set is designed for continuous operation with little or no attention. To accomplish this, all moving parts, except some portions of the valve gear, are entirely enclosed, and watershed partitions, placed between the frame and the lower cylinder heads, prevent water from the stuffing boxes mingling with the oil in the frame, and also making it impossible for oil within the frame to enter the cylinder on the piston rod. All wearing surfaces within the frame are supplied with an abundance of oil by means of a system of forced lubrication. With this system a small direct-acting pump forces oil through passages in the moving parts and through small pipes to the crank pin, wrist pin, crosshead guides, etc. The same system supplies the outboard bearing.

The generators are of the Sturtevant ten-pole type, direct-connected to the engine shafts by a flange coupling. They are designed for a wide range of load, and require little or no attention. Ample cooling surfaces and mechanical ventilation render the generators free from heating and burn-outs.



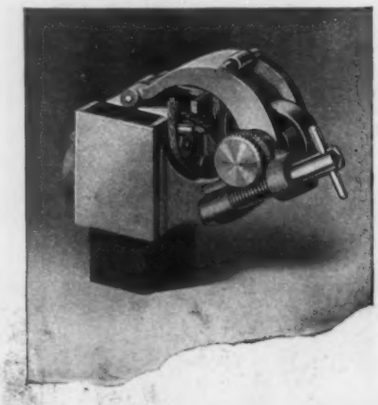
INSTALLATION SHOWING THREE STURTEVANT GENERATING SETS. 100 K. W., 250 K. W., AND 400 K. W.

These machines are capable of carrying an overload of 33 1-3 per cent for two hours without injurious sparking, and an overload of 100 per cent momentarily without destructive



GOVERNOR.

sparking or heating. The insulation will not deteriorate after continuous operation at normal temperature. At maximum



temperature, the insulation resistance between the windings and the frame is tested at alternating pressure of at least 1,500 volts at 60 cycles for a period of 60 seconds.

BRUSH.

The armature is of the iron-clad, drum-wound type, the core being built up of sheet steel segments, clamped between end flanges and provided with vanes which maintain a constant blast of air over the surfaces of the winding. The armature is multiple-wound and provided with cross-connecting rings, so that all brushes of the same polarity are maintained at the same potential, a feature that insures a uniform pole strength.

The commutator, mounted on an extension of the armature, is built up of drawn copper segments, which are insulated with amber mica of the best quality, of a thickness that makes impossible an accidental breakdown. So perfect is the commutation of these generators that the necessity of turning off the commutator is a very remote possibility.

Carbon brushes of a size that current density will never exceed thirty amperes per square inch, are held in the latest design of sliding-socket shunt brush holders, which are clamped on a composition frame, insulated from the brush ring itself. Each brush holder can be adjusted separately and removed for cleaning and repairs, or the entire brush ring may be rotated by a hand wheel.

A NEW ASBESTOS INSULATING MATERIAL.

Asbestos Wood, a recent product of the H. W. Johns-Manville Co., is now being largely used as an electrical and fire-proof insulating material. Many advantages are claimed for it over marble, slate, fibre and wood, for switch boards, switch bases, insulating pieces, etc., as well as for general fire-proof construction. It is easily worked with wood-working tools and can be sawed, nailed or screwed the same as hardwood lumber. It is absolutely fire-proof, making it especially desirable for all construction where there is danger of short circuits.

One of the many applications of Asbestos Wood is in the construction of doors in front of high voltage transformers and switches in high tension stations, where an absolutely fire-proof and insulating material is essential.

The insulation resistance is extremely high, being almost equal to that of sheet mica, which is the best insulating material known. Asbestos Wood has a smooth surface and will take any kind of finish that may be desired. For electrical purposes it is regularly furnished in Ebony finish. The H. W. Johns-Manville Co., of New York, have recently issued a booklet fully describing this product.

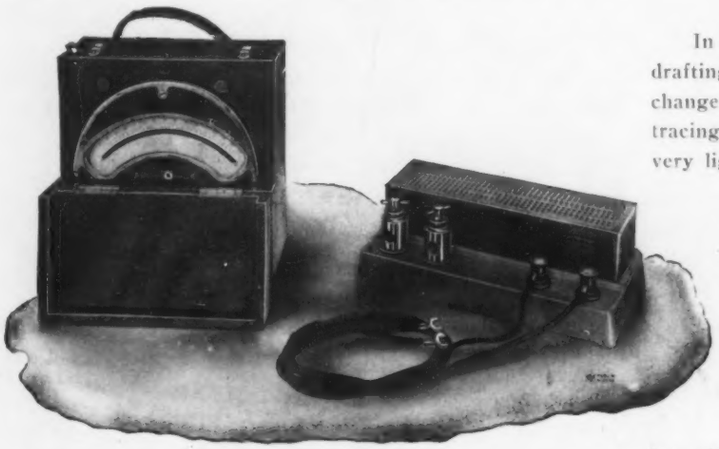
A NEW RAILWAY MOTOR PINION.

The General Electric Company, Schenectady, N. Y., reports that the remarkable properties which are exhibited by the new Grade F pinion now being placed on the market have caused a number of railways to introduce it in various classes of service. The physical characteristics of tensile strength and elastic limit are greatly in excess of those ordinarily found in this part of the equipment, and the claim that one of these pinions will outlast three ordinary pinions is apparently well founded.

As the vital factor of gear economy is the maintenance of the correct outline of the teeth, it is frequently, if not generally, necessary to replace the pinions two or three times during the life of a single gear. The substitution of Grade F pinions for the ordinary soft pinion will, therefore, eliminate all the expense for these renewals as well as prevent the inefficient operation of pinions with worn teeth. Worn pinion teeth produce among other evils an increased demand on the power station, excessive wear on motors and trucks, and a highly objectionable noise. Even without the economy in renewals, therefore, a pinion having a life approximately equal to the gear is a good business investment. The General Electric Company is furnishing the Grade F pinion on all new equipments.

A NEW LINE OF DIRECT CURRENT PORTABLE INSTRUMENTS.

A new line of direct current portable instruments, known as Type DP, has been placed on the market by the General Electric Company. This type of instrument has been designed especially for laboratory and general testing purposes, and includes a complete line of ammeters, voltmeters, mil-ammeters and milli-voltmeters, with the necessary portable shunts. These instruments are constructed on the well-known D'Arsonval principle, the coil of wire carrying the current to be measured, or a shunted portion of it, being wound on a rectangular frame mounted on jeweled bearings. This frame is free to move in the annular space between a soft iron core and the pole pieces of a powerful permanent magnet.



The case enclosing the mechanism of the instrument is of drawn steel with a cast iron cover, thus thoroughly protecting the instrument from the influence of stray fields. The magnets used are of the highest grade of magnet steel obtainable, and their permanency is assured by improved processes of aging and hardening. High torque is secured through efficient design. The scales are uniform throughout their entire range, and are very legible. To eliminate errors due to parallax, the instruments are equipped with flat pointers viewed on edge, and a mirror is placed under the scale.

Ammeters are made self-contained in capacities up to and including 30 amperes. For higher ranges up to 2,000 amperes a milli-voltmeter with scale marked directly in amperes is used with a portable shunt. These shunts are designed to give a uniform drop of 200 milli-volts at full load rating, and are, therefore, interchangeable. The milli-voltmeters used with these shunts are also interchangeable. The portable shunts are mounted on a base of aluminum alloy and are protected by a perforated sheet metal casing. This gives a very light and durable construction. They are furnished with a leather handle to facilitate transportation. If desired, two or three shunts can be furnished combined in one case.

When an instrument is desired for a class of work which does not require extreme precision, a DP milli-voltmeter can be furnished for use in connection with switchboard shunts, the instrument giving full scale deflection when subjected to a 60 milli-volt drop in potential, or a tap may be brought out at 60 milli-volts on the standard 200 milli-volt voltmeter, enabling it to be used with both portable and switchboard shunts. Where it is desired to use one instrument to cover a wide range of current, a milli-voltmeter can be furnished for use with any combination of single, double or triple rated shunts. The standard capacities of the portable shunts have been so selected that regardless of which capacities are chosen, the scale readings may be quickly determined.

Voltmeters of the DP type are furnished self-contained in capacities up to and including 750 volts. Double scale instruments can be supplied if desired. For measuring very low voltages and currents DP instruments can be furnished with the scales marked in milli-volts and mil-amperes. As shown in the illustration this type of portable meter is very neat in appearance. The carrying case is of mahogany, and all metal parts have oxide finish with nickel trimmings.

MOTOR-DRIVEN ERASER.

In even the most careful work in engineering offices and drafting rooms, mistakes will occasionally be made and changes are frequently necessary, requiring alterations in tracings. It is well known by draftsmen that erasing with a very light fast motion will remove the lines without a scar, but most draughtsman do not have the patience to do the work without putting too great a pressure on the rubber, and the result is a marred tracing. The use of a scratcher leaves the poorest job of all. For these reasons an eraser driven by a small electric motor finds great favor among draughtsmen. If desired, the motor may be carried from table to table, as its weight is but little. In some cases a separate bench is used for erasing, and all tracings, etc., requiring correction are brought there.

The motor is supplied for either direct or alternating current, 1/12 or ⅛ horsepower. The high speed of the motor gives the circular eraser the required high speed so that but a light pressure is required to remove any line desired. The tendency of men unfamiliar with the use of these erasers is to put too heavy a pressure on the eraser. This results in overheating the paper, and in some cases may injure it enough to spoil the drawing. But with a little practice any one may readily learn to use the eraser very rapidly and accurately. The complete outfit is supplied by the Coates Clipper Manufacturing Company of Worcester, Mass.

AMERICAN CYANAMID PLANT.

The contract for the construction of the first cyanamid plant on this side of the water has been let by the American Cyanamid Company to Westinghouse, Church, Kerr & Co., of New York City. The plant is at Niagara Falls on the Canadian side. The initial capacity will be 7500 tons per annum. There are eleven cyanamid plants in Europe, projected, in process of construction, or in operation, and their aggregate annual capacity is 166,000 tons. Inasmuch as America supplies a considerable portion of the feed stuffs for Europe, it is likely that the expansion of the American plant for the purpose of agricultural fertilizer will be very rapid.

Dossert & Co., 242 West Forty-first Street, New York City, have received orders from Walter Kidde for 2-way connectors, cable taps, and terminal lugs for use in the wiring of the plant of the American Hard Rubber Company, College Point, L. I.

NEWS NOTES

INCORPORATIONS.

Oakland, Cal.—The Daisy Oil Company, capital stock, $500,000, has been incorporated here. F. E. Horton and A. A. Bussey, of Oakland, and W. J. Rhoads, Jr., of Stockton, are directors.

San Francisco, Cal.—The Federal Oil Co., capitalized at $1,000,000, has been incorporated here. Shares are $1 each, and stock has been subscribed by J. Barneson, N. H. and I. H. Frank, and C. A. Shuey.

Los Angeles, Cal.—The Submarine Oil Co. has been incorporated with a capital stock of $1,000,000,000. The directors are H. B. Pearson, F. N. Burger, D. S. Elder, G. A. Carter, J. M. Eshelman, and P. P. Hovey.

Billings, Mont.—The Hardin Water & Power Co., composed of citizens of Hardin and Billings, has been organized for the purpose of supplying both electricity and gas for lighting purposes, and also water for all purposes, to the town of Hardin. The company is capitalized at $30,000.

San Francisco.—The Union Electrical Manufacturing Company has been incorporated with a capital stock of $50,000, shares $1 each. Fifty shares have been subscribed by A. A. Clue, while L. G. Copeman, G. M. Fisk, P. A. Clifford, and F. J. McNulty subscribed ten shares each. Place of business, San Francisco.

Los Angeles, Cal.—Articles of incorporation have been filed by the Long Beach Inner Harbor Gas Co., with a capital stock of $500,000. Among the directors of the company are Horace M. Dobbins, Pasadena, and F. W. Stearns, Long Beach. This company is a consolidation of the Long Beach and Inner Harbor Gas Companies.

Spokane, Wash.—The Orient Water Power Co. has been organized by Spokane capitalists, for the purpose of generating electricity for power. Arthur Phillips is president, Col. E. D. Sanderson vice-president, and Wm. Davidson secretary. Plans have already been made for a $75,000-plant, to be erected at Orient, and preliminary plans drawn for another plant, to be located in Ferry County.

ILLUMINATION.

Madera, Cal.—John F. Beales, of Los Angeles, has been here for the past week looking over the field with the view of installing a gas plant.

Riverside, Cal.—The Banning Home Gas Company has filed plans and specifications for its plant to cost $14,500. The contract has been let to J. R. Thompson of Los Angeles.

Pasadena, Cal.—On June 2d the City Council approved the electric lighting supplies appropriations, and contracts were awarded to the Maloney Electric Company and to the Westinghouse Company.

Los Angeles, Cal.—The amalgamation of the Long Beach and the Inner Harbor Gas Companies is expected to result in a much superior service. The companies have already joined their mains, and are expected to make some important extensions.

Richmond, Cal.—City Attorney Hart has made the statement that if the Board of Trustees will grant a franchise and if the field is found to be unmonopolized, a Santa Clara capitalist will soon lay mains to this place and supply the city with gas for fuel and lighting purposes.

Petaluma, Cal.—E. C. Jones, of San Francisco, chief engineer of the gas department of the California Gas & Electric Corporation, and Sherwood Grover, assistant engineer of the company, were here the last week in May, inspecting the gas system of the Petaluma Gas & Electric Company, with the view of making some improvements in the near future.

San Francisco.—The Permanent Down Town Association, composed of the merchants and property owners of the Market Street district, is going to erect serviceable and artistic lighting poles in the district bounded by Market, Powell and Sutter Streets, at an expense of about $20,000. The poles will be presented to the city supervisors, who have agreed to furnish the lights. There will be six poles to the block, each pole supporting five globes.

San Francisco.—City Attorney Long has advised the commission on electricity that it had no power to remove the chief of the department of electricity and make a new appointment unless under the civil service provisions of the charter. Long holds that Hewitt is a civil service employee and that he cannot be removed unless given a trial after charges have been filed against him. The commissioners, for some time, have been considering the advisability of removing Hewitt, as they were not satisfied with his management of the department.

WATERWORKS.

San Francisco.—The time of opening the bids for the new government pumping plant at the Presidio in this city has been postponed until June 20th.

Santa Clara, Cal.—The city supervisors have decided on improving the municipal water system. A contract with the G. E. Dow Pumping Engine Company for new machinery to the amount of $7,124 was awarded. The system of mains will also be extended.

Oroville, Cal.—At a recent meeting of the City Trustees where water irrigation was discussed, the water company agreed to put its system in such a condition within a year as to give satisfactory service for this purpose. Provisions for repiping the city were also made.

Los Angeles, Cal.—The Board of Public Works has approved the specifications of the work on the most difficult parts of the Los Angeles aqueduct in what is known as the Jawbone section. The city will give private contractors an opportunity to bid on the work, and if they make satisfactory offers the work will be conducted under private contracts in this section.

TRANSMISSION.

Exeter, Cal.—The Mt. Whitney Light & Power Company will soon begin the erection of a sub-station here.

Centralia, Wash.—Local interests have secured options on the exchanges of the Sunset Telephone Company at Centralia and Chehalis. If the deal is closed the Centralia men will build an entirely new and up-to-date exchange.

Oroville, Cal.—The Great Western Power Company has commenced the erection of an immense dam at the intake of its tunnel. It will be 125 feet high and will turn the river through the tunnel to the company's power house at the lower end of the tunnel. Engineer Veile expects the Great Western plant to be supplying power to many of the nearest towns by October.

Baird, Shasta County, Cal.—William Ellery, of Redding, has filed on 124,000 inches of water of the McCloud River at a point near here for the purpose of generating electricity for power. This is the largest water location ever filed in Shasta County. The notice states that the water will be diverted from the river at a point in Sec. 5, Tp. 35 N., R. 3 W., and thence to the power house to be located on Section 9.

Seattle, Wash.—The regents of the University of Washington have postponed the awarding of the contract for the erection of the proposed power house for the university. The lowest bid for the structure was that of H. Chase & Co. of $15,907, and for machinery that of the Hallidie Machinery Co. at $72,900. It is probable that some time will elapse before the final awards are made.

Oroville, Cal.—J. W. Goodwin, president of the Oro Light, Water & Power Company, has issued a statement to the Chamber of Commerce, in which he sets forth that his company has spent about $500,000 in improving its system and is contemplating the spending of $50,000 more. The report also states that the company is contemplating the reduction of the power rates in the near future.

San Jose, Cal.—Prof. John J. Montgomery, who formerly gained some notice as an aeroplane builder, has completed the invention of an apparatus which he claims will supplant the skilled operator in the telegraph office. The contrivances are planned to transmit and receive messages and to relay them by a system of machines with typewriter keyboards, the receiving instrument automatically printing the message as it is sent. The ability to give the sending and receiving instruments a certain tension which will make wire-tapping impossible is one of the features of the new invention. The Telautoprint Company, of San Francisco, will try to interest the big companies in the machine.

TRANSPORTATION.

San Bernardino, Cal.—Last week the county supervisors sold to John H. Fisher, of Redlands, the franchise of the Central Railway, from the city limits of Redlands to Redlands Junction.

Stockton, Cal.—The Central California Traction Company has applied for a franchise for an electric road in this city. The matter will be taken up by the city trustees at a meeting to be held June 15th.

Los Angeles, Cal.—The City Council has authorized the opening of Fifth Avenue, between Castillo and Bath Streets, in order to provide for the extension of the street railway system to the entrance of Oak Park.

Ventura, Cal.—Julian P. Jones and Frank M. Packard, the owners of the franchise for an electric road between this city and the Ojai and Matilija, have arrived here and are making necessary arrangements for the preliminary work on the line.

Redding, Cal.—The Northern Electric Light & Power Co. was awarded a franchise to erect poles and string and maintain wires in the corporate limits of the city at the meeting of the trustees on June 2d. The franchise is for a term of fifty years.

Huntington Beach, Cal.—Col. H. S. Finley, of Santa Ana, has assured the citizens of this section that the Pacific Electric Railway intends to extend the line which is to be built from Huntington Beach to the cannery near here on to Santa Ana by the way of Talbert.

Pasadena, Cal.—The Lincoln Avenue Improvement Association of this city met recently and decided to give one more week's time to the committee which is trying to interest the H. E. Huntington interests in the extension of the street railway system on Lincoln Avenue.

Los Angeles, Cal.—Last week the City Council agreed that a franchise would probably be granted for a cable road up Avenue 43 to the Mount Washington District. The property owners of this district, west of Marmion Way, are opposed to the cable railway being built on their street, and on May 29th petitioned the council not to sell the franchise asked for.

Baker City, Ore.—During the summer it is the intention of the Grand Ronde Electric Company to construct about thirty-three miles of road from Union to make connection with the Rock Creek line in Baker County. The road will connect with the power lines of the Fremont Power Company, thus insuring an abundance of power. The estimated cost of construction is $50,000.

FINANCIAL.

Pasadena, Cal.—The water companies of this place state that it is hoped a bond election for $1,000,000 for the purpose of acquiring water plants, will be called soon.

Santa Barbara, Cal.—The City Council recently adopted resolutions calling for a vote at an early date on the proposed bond issue of $200,000, for the completion of the water tunnel at that place.

Dinuba, Cal.—The City Clerk has advertised the sale of the bond issue of $20,000 for the purpose of erecting a municipal waterworks plant. The bonds are of $1,000 each, and bear 5 per cent interest.

Vallejo, Cal.—At the election held at Vallejo, Cal., on June 2nd, the bond issue carried by a large majority. The bonds, to the amount of $85,000, are for money to increase the municipal water system.

Los Angeles, Cal.—The city of Los Angeles is offering for sale municipal bonds to the amount of $340,000, which have been authorized for the construction of the Los Angeles aqueduct. The denomination of the bonds is $200, with interest at 4 per cent, payable semi-annually. The City Council held a special adjourned meeting on June 2nd to pass some legislation relating to the bond sale.

TELEPHONE AND TELEGRAPH.

Ephrata, Wash.—A telephone line is being planned to connect Ephrata with Soap Lake. The Farmers' Mutual is behind the project.

San Francisco, Cal.—The ordinance regulating the rates to be charged by the telephone company during the coming fiscal year has been passed to print by the Supervisors by a vote of 15 to 1.

Mount Vernon, Wash.—A franchise was granted to R. J. Kellogg, of Baker, for the construction and maintenance of a telephone system over and along the county roads between Sedro-Woolley and Baker.

Palouse, Wash.—At a meeting of the Garfield-Palouse Telephone Company held at the Herman Curtis place, it was decided to rebuild the line, and with that end in view, poles and wire have been ordered.

New Westminster, B. C.—Workmen commenced operations this week on the erection of a long-distance telephone line from this city to Hammond, Haney, Whonnock, Ruskin, Mission and other points along the north bank of the Fraser River. The line is being built for the British Columbia Telephone Company.

Honolulu, H. T.—The franchise of the Standard Telephone Company will expire on June 20th, but arrangements are being made to have it extended, so as to allow a little more time before the work is started. In the event of the extension of time not being granted, the company will ask for a new charter and franchise and reorganize.

Tacoma, Wash.—In the Federal Court, June 1st, damages of $3,750 were awarded to A. Parmenter in his suit against the Pacific States Telephone & Telegraph Company. A logger felled a tree which struck the wires that pulled down a telephone pole that broke the shoulder of Parmenter, who was driving on the Thurston county road. Damages in the sum of $10,000 were asked.

FINANCIAL.

The Sunset-Monarch Oil Company has levied an assessment of 10 cents per share, delinquent June 18th, sale day, July 7th.

The Union Oil Company will hold a meeting of stockholders August 20th in Los Angeles to act upon a proposition to increase the capital stock to $50,000,000.

Salt Lake, Utah.—By the filing of a $10,000,000 trust deed a few days ago, the Telluride Power Company indicates its intention to begin an extensive improvement of its system in Utah, Colorado and Idaho.

San Diego, Cal.—The William R. Staats Company, of Los Angeles, has received its second consignment of city bonds, having paid the money over to the City Treasurer, and received the bonds a few days ago.

Los Angeles, Cal.—Another installment of Los Angeles aqueduct bonds has been received from the American Bank Note Company. It comprises an issue of $340,000, in denominations of $200. The bonds are known as "Series D."

Yuba City, Cal.—At a meeting of the City Trustees, held on June 1st, it was ordered that an election be held on June 30th, for the purpose of deciding the question of bonding the city for $30,000 for the erection and equipment of a municipal water works system.

Gridley, Cal.—The Board of Trustees at a meeting last week voted unanimously for a resolution declaring the need of a municipal water system and electric lighting system. They set forth the fact that it will be necessary to bond the city for these improvements.

OIL.

Salinas, Cal.—The Associated Oil Company is planning for the improvement of its plant here by the installing of its own tanks and machinery in the yards, so as to facilitate the handling and shipping of its products.

Bakersfield, Cal.—The Adeline Oil Company has struck a fine flow of water in the Sunset district while sinking a well. The flow at present is about 30,000 barrels per day. The great scarcity of water in this district makes the strike an important one, and if the flow of the well does not diminish, the water question will be solved there to a great extent.

Coalinga, Cal.—There is a rumor that the proposed pipe line from Coalinga to Mendota will not be constructed immediately as the production does not warrant it. The oil which is now produced is being handled without difficulty by the Coalinga Oil & Transportation Co.'s pipe line to Monterey, which has capacity of 12,000 barrels daily, and the Southern Pacific oil trains, which take out about forty cars a day, and the Standard pipe line with its capacity of 20,000 barrels.

Florence, Cal.—J. T. Wallace, vice-president and director of the United Oil Company, one of the largest drilling and refining concerns in the West, has filed a suit against the company on behalf of himself and other stockholders, for the sum of $1,000,000, and has asked that a receiver be appointed for the company. The complaint alleges that the United Oil Co. has been mismanaged and that there have been illegal combinations and collusions with the Standard Oil Co., the Continental Oil Co., and other persons and incorporations.

San Francisco.—The report that the Standard Oil Company has offered $20,000,000 for the Coalinga properties of the California Oil Fields, Ltd., has been officially denied by D. E. Scofield, vice-president of the Standard Oil Company, who denied that any negotiations for the property were under way on the part of his company. There is a persistent report that some company, whether it be a subsidiary company of the Standard or not, is in the field for the property. The holdings in question are very valuable and surround property of the Standard Oil Company on three sides.

Los Angeles.—Work has begun to make the old Southern Pacific tracks from Sentous to Port Los Angeles, a part of the Los Angeles-Pacific trolley system. General Superintendent Robert P. Sherman stated recently that electric cars will be in operation over this new line the first week in July.